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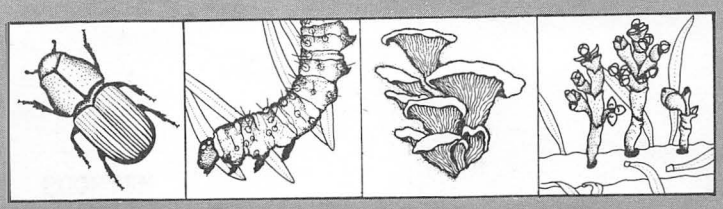

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EFFECTS OF DIPEL® WETTABLE POWDER FOR FOLIAGE PROTECTION AGAINST WESTERN SPRUCE BUDWORM 1 AND 2 YEARS FOLLOWING AERIAL APPLICATION

Forest Insect and Disease Reference Material
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by

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A pilot control project using Bacillus thuringiensis Berliner (Dipel®) (Bt) against the western spruce budworm 3/ was conducted in 1975 on the Gallatin National Forest. The treatment was applied to third and fourth instar larvae (McGregor, et al. 1976). Dosage was 1 pound (7.2 BIU) in 2 gallons of water/acre. A commercial surfactant, Bio-film®, was added at the rate of 16 ounces/100 gallons of spray. Rhodamine B extra S® dye was added at the rate of .04002/1.057 quarts for spray deposit assessment. The experimental design consisted of six randomized blocks; three treated with Bt and three left untreated for checks. Size of blocks ranged from 1,075 to 1,220 acres (figure 1).

Corrected budworm mortality at 21 days postspray was 50.4 percent. The following summer aerial observations indicated that treated blocks were greener than check blocks. Therefore, an evaluation was made to determine if foliage protection was provided by Bt the years following treatment.

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METHODS

In September 1976, defoliation was estimated for each block. Crews were uninformed as to which blocks were treated. They were trained to visually estimate defoliation using the following coding system:

0	No defoliation
1	Light defoliation (less than 25 percent)
2	Moderate defoliation (26-75 percent)
3	Heavy defoliation (greater than 75 percent)

A systematic sample of 20 points was established in each block to obtain an unbiased estimate of defoliation. At each point five trees were selected using the nearest neighbor technique. Each sample tree was observed for damage and the damage class determined.

In the following year, 1977, blocks were resampled to determine second year treatment effects. Twenty-five 3-tree clusters were sampled in each block. Four midcrown branches were removed and defoliation estimates made on 25 new shoots per branch. Using the following system, estimates of defoliation for each tree were made and cluster means computed.

Defoliation (percent)	Rating
0-25	1
26-50	2
51-75	3
76-100	4

An analysis of variance was used to test for differences between blocks. Tukey's test was used to determine which blocks were different from each other.

RESULTS

An analysis of variance detected differences between blocks 1 year after treatment but no differences could be detected 2 years after treatment (table 1). Tukey's test of significance showed treated blocks were significantly different from check blocks at the 95 percent level 1 year after treatment (table 2).

Table 1.--Results of analysis of variance 1 year after treatment.

Source	Degrees of freedom	Sums of squares	Mean	F Value
Total	599	664.86	1.1099	
Blocks	5	366.07	73.21	147.83*
Clusters	19	14.76	.777	.569
Trees	4	1.2233	.30587	.618
Residual	571	292.80	.495	

* Significant at the 99 percent level

Table 2.--Tukey's test to determine differences between blocks 1 year after treatment.

Check blocks	Block means
Swan	2.53
Spanish	2.00
Dudley	1.24
Bt blocks	
Doe	0.92
Smith	0.64
Lime	0.26

Blocks connected by lines are not significantly different from each other at the 95 percent level.

CONCLUSIONS

This evaluation showed that Bt provided measurable foliage protection 1 year after treatment, but no differences were evident after 2 years. We recommend future Bt tests include postspray population measurements in the pupal and/or adult, and/or egg stage, and that foliage protection be measured the following year. The effects of Bt on the population should not be evaluated in the same manner as fast-acting insecticides.

REFERENCES CITED

McGregor, M. D., D. R. Hamel, and R. C. Lood. 1976. Dipel® wettable powder (*Bacillus thuringiensis* Berliner) as a control agent for western spruce budworm *Choristoneura occidentalis* Free. USDA Forest Serv., Forest Environ. Protn. Rept. 76-11, 17 p., Missoula, MT.